

Engineering Design File

PROJECT NO. 23833

OU 7-13/14 In Situ Grouting Project Electrical Utilities



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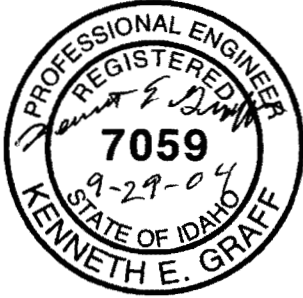
**OU 7-13/14 In Situ Grouting Project
Electrical Utilities**

EDF No.: 5122 EDF Rev. No.: 0 Project File No.: 23833

1.	Title:	OU 7-13/14 In Situ Grouting Project Electrical Utilities		
2.	Index Codes:			
	Building/Type	WMF-700 Subsurface Disposal Area	SSC ID	N/A
			Site Area	Radioactive Waste Management Complex
3.	NPH Performance Category:	_____ or <input checked="" type="checkbox"/> N/A		
4.	EDF Safety Category:	_____ or <input checked="" type="checkbox"/> N/A		
		Consumer SCC Safety Category: Grade _____ or <input checked="" type="checkbox"/> N/A		
5.	<p>Purpose: This engineering design file (EDF) provides technical requirements for electrical utilities for the In Situ Grouting (ISG) Project for the pits and trenches in the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex. Information in this EDF is presented as a basis for a performance type procurement of ISG services and is intended to serve as a guideline for procurement and cost estimating.</p> <p>Scope: The EDF provides the system design requirements, design codes, reliability requirements, and capacity requirements for the trackhoe electrical power, the SDA area electrical power, and the support facilities outside the SDA for the ISG Project. Potential procurement and technical risks are also summarized.</p> <p>Results: Results are presented in the body of the EDF.</p> <p>Conclusions Reached: The electrical utilities directly supporting the injection of grout must be very reliable for the schedule to be accomplished. Portable electrical power cables must be very rugged or monitored closely to provide a safe and productive operation.</p> <p>Recommendations: The procurement specification should include the equipment capacities as a minimum requirement. Code and quality requirement compliance for the electrical components, as identified in this EDF, will have the reliability to ensure the ISG Project can be completed on time.</p>			
6.	Review (R) and Approval (A) and Acceptance (Ac) Signatures: (See instructions for definitions of terms and significance of signatures.)			
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ACRONYMS

ANSI	American National Standards Institute
ISG	in situ grouting
NFPA	National Fire Protection Association
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
TFR	technical and functional requirements

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OU 7-13/14 IN SITU GROUTING PROJECT **ELECTRICAL UTILITIES**

1. PURPOSE

The purpose of this engineering design file is to identify power needs for lighting, instrumentation, pumps, and facility loads to support the In Situ Grouting (ISG) Project.

2. BACKGROUND

In situ grouting will be performed at the Radioactive Waste Management Complex (RWMC), located at the Idaho National Engineering and Environmental Laboratory. The Subsurface Disposal Area (SDA) is an area of approximately 39 ha (approximately 97 acres) located within RWMC. In situ grouting is a method for injecting grout into the soil for contaminant grouting, which stabilizes the waste in the pits and trenches located in the SDA, or for foundation grouting, which is used for structural foundation enhancement needed for cap installation.

Grouting in the SDA will be conducted with a large hydraulic excavator (i.e., trackhoe) that deploys a roto-percussion drill rig to inject grout into the waste under high pressure. A high-pressure grout pumping system will be integrated with the trackhoe drill. Operations, maintenance, monitoring, and radiation control systems will be deployed to support field operations. A grout supply vendor will be subcontracted to provide grout as specified by the project. It is anticipated that the subcontractor will mix the grout on demand at an onsite batch plant. Grout will be supplied to the high-pressure pumping system by truck.

To minimize the risk of mobilizing contaminants within the waste zone, the project has chosen a single-phase, nondisplacement, jet grouting approach, which does not require injection of high-pressure air or free water. This approach drives a drill stem to the bottom of the waste zone, then injects grout at high pressure as the drill stem is removed. During this process, excess grout is returned to the surface along the outside of the drill stem.

The ISG Project is anticipated to be complete in seven years, with one drill rig used the first year and an anticipated three drill rigs used for the second through seventh years. This design is based on the required jet grouting capacity of three drill rigs operating simultaneously.

12.5 kV power is available from the RWMC power system. Existing power poles can be used to provide power to the area around the SDA. Portable generators or generators on the trackhoe will be used in the SDA to minimize having to move and protect medium voltage power cables.

3. SCOPE

Three general areas can be identified as needing electrical power:

1. Trackhoe electrical power—power for the instrumentation, air conditioning, and miscellaneous loads attached to the trackhoe
2. The area in the SDA supporting the trackhoe and grouting process—power for the equipment in the general area of the trackhoe that supports the grouting process and the process monitoring equipment

3. Area outside the SDA supporting the grouting process and the grout mixing facility—power supporting the grout mixing equipment and facilities associated with the grouting process.

4. REQUIREMENTS (FUNCTIONAL, PERFORMANCE, AND TECHNICAL)

The requirements for the electrical utilities are divided into three areas that have different needs because of the function and location of the equipment (see Technical and Functional Requirements [TFR]-267, “Requirements for the OU 7-13/14 In Situ Grouting Project (Customer, Project, and System)” and TFR-269, “Requirements (Assumptions) for the OU 7-13/14 In Situ Grouting Project”).

Three electrical power systems have been identified to support the SDA grouting operation: the trackhoe electrical system, the SDA grouting support electrical system, and the general area grouting support electrical system.

The trackhoe will be moving often during each day, which requires the electric power to be built into the trackhoe or have electrical power cables trail the trackhoe. A generator being built into the trackhoe has many advantages over trailing electrical power cables. Management of the cables would be expensive and time consuming. Even with rugged armored electrical power cables, the danger of damaging the cables and exposing the worker to electrical shock is significant.

In the SDA, supporting the grouting operation, are a number of pieces of equipment that requires electrical power. This equipment requires relocation occasionally. Over the years of the ISG Project this equipment will require many relocations. On board generators for each piece of equipment are not easily obtainable, and would require support and maintenance programs for each piece of equipment. Providing commercial power for this equipment would require management of large, medium-voltage cables that would create safety and reliability issues even with the most rugged of armored cables. A local area generator that follows the grouting equipment is the electrical power supply method providing a balance between the other two options. The local area generator will follow the grouting equipment and supply the various loads at safer voltages than the commercial feeder, but will not need the maintenance and support of having a generator on each individual piece of equipment.

The area supporting all of the grouting operations in the SDA has a number of facilities that require electrical power. The existing facilities that are to be used are expected to have adequate power to support their use. There are a number of new facilities to be built or moved in that require electrical power. These will be supplied by the commercial electrical power system at RWMC. The commercial power system will feed the stationary facilities outside the SDA; therefore, they will not have the safety and electrical power cable issues because there are no electrical power cables to move or relocate on a routine basis. Also, the commercial electrical power at RWMC will be much cheaper than if a generator was delivering the electrical power.

The electrical power system associated with the trackhoe requires power to keep the operator comfortable and alert. The major loads on the trackhoe are air conditioning, illumination of controls and work area, and instrumentation.

Electrical power for data gathering and transmission needs to be very reliable in order to maintain the productivity needed to meet the aggressive schedule.

5. SYSTEM CLASSIFICATIONS, CATEGORIZATIONS, AND DETERMINATIONS

An ISG safety authorization basis document is being written to address the issue of system safety classification; however, the following determination will be assumed until the document is issued:

All electrical equipment and installation shall be consumer grade.

6. ASSUMPTIONS

The trackhoe instrumentation power source will be a separate portable generator, rather than use the trackhoe DC battery as the electrical power source. The trackhoe DC battery can be a backup to the portable generator.

Power for miscellaneous needs in the SDA in the immediate area of the trackhoe will be provided with a portable generator near the trackhoe.

The 12.5 kV RWMC power system will be used to provide the power needs outside the SDA, rather than bringing in portable generators.

The grouting operation will be performed when freeze protection will not be required. If freeze protection is needed, additional power will need to be added.

Trackhoe cab ventilation will not have a safety classification greater than the remainder of the trackhoe.

7. DESIGN CRITERIA

Power to support instrumentation on the trackhoe shall be reliable enough to provide continuous monitoring of all critical data; backup supply through a separate portable generator will be needed or the instrumentation fed directly from the trackhoes' battery.

Power to support the high-pressure pump shall be reliable enough to provide continuous monitoring of all critical data; backup supply will be needed or the instrumentation fed directly from the high-pressure pump engines' battery.

Monitoring trailer instrumentation and recording equipment shall be reliable enough to provide continuous monitoring of all critical data.

7.1 Applicable Design Codes and Standards

National Fire Protection Association (NFPA)-70, "National Electrical Code"

NFPA-70E, "Electrical Safety Requirements for Employee Work Places"

American National Standards Institute (ANSI)-C2, "National Electric Safety Code."

7.2 System Design Requirements

7.2.1 Trackhoe Electrical Requirements

120 Vac will be provided for air conditioning and other accessories for the comfort of the operator and reliable operation of sensitive electronic equipment. A 5-kVA generator will be needed for this load.

24 Vdc will be provided for instrumentation and control electronic equipment. This power source must be highly reliable with battery support. Failure of this equipment would likely require manual recording of the required grouting information, thereby slowing the grouting operation. The power cabling feeding the monitoring instrumentation must be well protected in order to maintain reliable operation.

A One-Line electrical drawing, illustrating an electrical system for trackhoe accessory and instrumentation power, is located in Appendix A.

7.2.2 Subsurface Disposal Area Electrical Requirements

The area around the trackhoe needs power for a variety of equipment. The largest pieces of equipment needing electrical power are the following:

- Low pressure grout pump—20 hp
- Oil field mud screen—3 hp
- Rotary valve—3 hp
- Pressure washer—5 hp
- Low-pressure clean water pump—2 hp
- Control trailer—20 kVA
- RadCon trailer—20 kVA
- Lighting and miscellaneous equipment (e.g., instrumentation and radiological monitoring)—2 kVA.

A 100-kVA generator will provide this load with 25% expansion capability.

Portable cables will need to be reused in multiple locations for long periods of time. These portable cables will be subject to sunlight, water, petroleum, grout, dirt, and heavy physical abuse. Power cables will need to be inspected periodically; armored power cables greater than #10 awg should be inspected monthly for damage. Smaller portable cables need to be inspected more often. All portable power cables shall have a ground wire. Plugs and sockets on the portable power cables should be of the twist and lock type so they will not easily fall out of the socket.

The electrical equipment needs to be rugged to allow for multiple relocations as the grouting locations shift.

A spare generator should be readily available to maintain productivity due to generator failure.

When operation is required and the sun is unavailable (e.g., early morning in the Spring, late Fall, and for night maintenance activities), lighting in the operational area shall be 30-ft candles, 50-ft candles for high activity areas, and 80-ft candles for intricate operations (e.g., changing bits at the bit change box).

A One-Line electrical drawing illustrating an electrical system at the SDA supporting the grouting process is located in Appendix A.

7.2.3 General Area Electrical Requirements

The electrical power for the grout mixing facility, repair and storage facility, and other facilities outside the SDA will be provided from the 12.5-kV, 3-phase line on the east side of the SDA. Existing power poles will be used to provide the power to the area near the south gate of the SDA. Two power poles will be added at the south side of the SDA to bring power into the south gate area.

A pad mounted 500-kVA transformer will convert the 12.5-kV, 3-phase power to 480-V, 3-phase power near the base of the south gate power pole.

The general area electrical system will provide power for grout storage and mixing, the maintenance and storage facility, area lighting, and receptacles.

The electrical power needs are:

- Grout storage and mixing—100 kVA
- Maintenance and storage facility—40 kVA
- Area lighting, data retrieval and storage facility, and miscellaneous equipment—20 kVA.

200 kVA from the 12.5-kV SDA electrical system will provide the electrical power need with 25% expansion capability.

A One-Line electrical drawing illustrating an electrical system for the grout mixing, repair, and storage facility area is located in Appendix A.

8. RISKS

Lightning protection for the trackhoe drill mast is recommended. The history of lightning in the SDA is two lightning strikes in the past 16 years. The drill string provides an excellent low resistance path for lightning to the earth through the SDA waste. Grouting in the SDA is expected to last long enough for at least one lightning strike to occur in the SDA during this construction. The lightning strike danger may be mitigated with a lightning arrestor terminal at a high point of the drill mast with a low resistance copper path to earth ground, which will shunt most of the energy into the earth. Another approach would be to shut down when the potential for thunderstorms approach.

9. LOGISTICS SUPPORT

The electrical system conceptually defined in this study will require logistics support consisting primarily of the following:

- Fuel for the generators on the SDA
- Electrical power from the Power Management organization.

10. RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

All components of the electrical system are off the shelf or can be commercially fabricated to distribute and provide electrical power from commercial electrical power sources at the south grout mixing facility and to generate the necessary electrical power for the grouting operations in the SDA.

11. APPENDIXES

Appendix A—Drawings

12. REFERENCES

ANSI-C2, “National Electric Safety Code.”

NFPA-70, “National Electrical Code.”

NFPA-70E, “Electrical Safety Requirements for Employee Work Places.”

TFR-267, “Requirements for the OU 7-13/14 In Situ Grouting Project (Customer, Project, and System).”

TFR-269, “Requirements (Assumptions) for the OU 7-13/14 In Situ Grouting Project.”

Appendix A

Drawings

OU 7-13/14 In Situ Grouting Project
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